THE

Journal of the Society of Arts,

AND OF

THE INSTITUTIONS IN UNION.

110TH SESSION.] FRIDAY, JANUARY 29, 1864. [No. 584. VOL. XII.

Announcements by the Council.

ORDINARY MEETINGS.

Wednesday Evenings, at 8 o'clock.

FEB. 3.—"On Instantaneous Engraving upon Metal." By Mons. E. VIAL (illustrated with experiments).

FEB. 10.—"On Fresco Painting, as a suitable mode of Mural Decoration." By J. BEAVINGTON ATKINSON, Esq.

FEB. 17.—"On Public and Private Dietaries," a sequel to the paper read on the 16th December last. By Dr. EDWARD SMITH, F.R.S.

CANTOR LECTURES.

Courses of Lectures on the following subjects will be delivered during the Session :—

The Operation of the Present Laws of Naval Warfare on International Commerce. By G. W. HASTINGS, Esq., Barrister-at-Law.

Fine Arts Applied to Industry. By W. BURGES, Esq.

Chemistry Applied to the Arts. By Dr. F. CRACE CALVERT, F.R.S.

The fourth lecture of Mr. Hastings' course will be delivered on Monday, 1st February, at 8 o'clock; the subject will be as follows :—

The Foreign Enlistment Act; its Operation on Commerce.

The following is a syllabus of Mr. Burges's Lectures :—

FEB. 8.—LECTURE I. INTRODUCTORY :—What is an art manufacture? Advancing state of English manufactures in an art point of view. Much owing to Government Schools of Art. Impediments to further progress:—1. Want of a distinctive architecture in the 19th century fatal to art generally. 2. Want of a good costume fatal to colour. 3. Want of sufficient teaching of the figure fatal to art in detail.—Hints for the advancement of Art applied to Industry.—Design of following lectures:—1. To take one or two phases of some particular industry in past times. 2. To compare them with our own phase of the same industry. 3. To offer suggestions for our future improvement.

FEB. 15.—LECTURE II.—*Glass.*—Antique glass, Venetian glass, modern glass (Powell, Chance, &c.); Mediæval stained glass; modern ditto; Mediæval enamels; modern ditto; (Legoste of Paris.)

FEB. 22.—LECTURE III.—*Pottery.*—Etruscan vases (Wedgwood); Italian majolica (Minton); Sèvres china; modern biscuit.

FEB. 29.—LECTURE IV.—*Iron and Brass.*—Antique bronzes; Mediæval ditto; modern French bronzes (Barbédienne); Mediæval dinanderie; modern ditto (Hardman, Hart, &c.); Mediæval and Renaissance wrought iron; modern ditto; cast iron.

MAR. 7.—LECTURE V.—*Gold and Silver.*—Antique and Mediæval plate; modern ditto (Elkington); Antique and Mediæval jewellery; modern ditto; Antique and Mediæval coinage; modern ditto.

MAR. 14.—LECTURE VI.—*Furniture.*—Mediæval furniture, oak and painted; Renaissance; 16th and 17th centuries; modern.

MAR. 21.—LECTURE VII.—The Weaver's art; Mediæval, Eastern, modern.

The Lectures will begin on each evening at 8 o'clock.

INSTITUTIONS.

The following Institution has been taken into Union since the last announcement :—

Crewe Mechanics' Institution.

The Christmas subscriptions are now due, and should be forwarded by cheque or post-office order, made payable to the Financial Officer, Samuel Thomas Davenport. All cheques and post-office orders should be crossed through Messrs. Coutts and Co.

Proceedings of the Society.

CANTOR LECTURES.

THE OPERATION OF THE PRESENT LAWS OF NAVAL WARFARE IN INTERNATIONAL COMMERCE. BY G. W. HASTINGS, ESQ.

The third lecture of this course was delivered on Monday evening, the 25th inst. A *résumé* will be given in the next number of the *Journal*.

SIXTH ORDINARY MEETING.

Wednesday, January 27th, 1864; James Heywood, Esq., F.R.S., in the chair.

The following candidates were proposed for election as members of the Society :—

Dutton, Robert, Cambridge-lodge, South Fields, Wandsworth, S.W.
Goodliffe, Fred. Gimber, Cecil-house, Cheshunt, Herts.
Goodyear, George Edward, Club Chambers, 15, Regent-street, S.W.
Kidd, John, 7, Wine Office-court, Fleet-street, E.C.
Offer, George, jun., 115, Leadenhall-street, E.C.
Walmsley, Henry Benjamin, The Elms, Acton, W.

The following candidates were balloted for and duly elected members of the Society :—

Adams, Thomas, 5, Alfred-terrace, Spa-road, Bermondsey, S.E.
Burn, Charles, 3, Middle Scotland-yard, Whitehall, S.W.
Byron, Thomas, Wolverhampton.
Dart, Richard, 12, Bedford-street, Covent-garden, W.C.
Flower, Charles Edward, Stratford-on-Avon.

Harcourt, Colonel Francis Vernon, 5, Carlton-gardens, S.W., and Buxted-park, Uckfield.
Moon, William, F.R.G.S., 104, Queen's-road, Brighton.
Rood, John Yeoman, Compton-street, Soho, W.
Simons, William, London Works, Renfrew, N.B.
Soul, Matthew Augustus, 3, Leadenhall-street, E.C.
Spode, J., Hawkesyard-park, near Rugeley.
Tasker, William, Halifax.
Wilson, Robert H. C., 12, Wilson-st., Gray's-inn-rd., W.C.

AND AS HONORARY CORRESPONDING MEMBER,

Coomàra-Swamy, Mutu, Mudeliàr, Ceylon.

The Paper read was—

ON THE METRIC SYSTEM OF WEIGHTS AND MEASURES, AND ITS PROPOSED ADOPTION IN THIS COUNTRY.

BY SAMUEL BROWN, F.S.S., VICE-PRESIDENT OF THE INSTITUTION OF ACTUARIES.

The great advantages, social, commercial, and political, which would attend the use of one system of weights, measures, and coins throughout the world, have generally been admitted, but as generally considered impossible. Such a result is frequently deemed to be merely the dream of a visionary, or the speculation of a philosopher, who has no practical knowledge of the world, and is incapable of appreciating the difficulties which stand in the way of accomplishing so desirable an object. It must be granted that the difficulties are great. There are prejudices to be overcome, ignorance to be enlightened, national pride to be vanquished, and, in many cases, trade customs, the growth of ages, to be abolished, before one nation can combine with another, much less several nations agree together to adopt a common system. Yet, in spite of all these obstacles, the present century has witnessed such great changes in the old practice, and all tending towards a uniform standard, that I propose to give a brief sketch of the present position of this question, and to show what has been done and is doing to carry on a work so important to the social condition of any country, and to the free interchange of its produce or manufacture with other countries.

It would occupy too much space and time to go far back to show the various systems which have been used, and the causes of the changes proposed or carried out. It will suffice for my present purpose to date only from the period of the Great Exhibition of 1851, to state what changes had then been effected, and what progress has since been made towards the realisation of this "dream" of a universal system. For that Great Exhibition, in itself and as the parent of others, so fruitful in results beneficial to the whole world, we can never be sufficiently grateful to the illustrious Prince Consort, to whose persevering energy and far-seeing intellect its success was mainly due, whose labours in the cause of social science have been the more appreciated, as his quiet and unobstrusive influence had been silently and imperceptibly turning the attention of the nation to the defects in our social system, and to the state of isolation in which in many respects we stood in regard to foreign nations.

The Great Exhibition naturally forced upon the public mind the question now under consideration. It was impossible to compare together the produce of the world's industry till the measures, weights, or values were reduced to a common system. Simple as it may seem, this was impossible at the time, because there was no system recognised by this country which would be admitted by others as a common standard. The consequence was, that some of the greatest advantages proposed by the Exhibition were lost; manufacturers particularly versed in one branch of trade might, by their special knowledge and with many laborious calculations, compare their own articles as to relative cost and value with those of other countries, and take hints for their improvement; but the general public could only entertain a sort of confused and indefinite admiration. Values and quantities were reckoned by all sorts of different standards, and true estimation and measurement were out of the question. The task of translating foreign monies and reducing foreign weights and measures to our own was, however, an essential part of the duties of the jurors, and, at the close of the Exhibition, the Society of Arts, which had been so mainly instrumental in carrying into effect the great idea, presented a memorial to the Lords Commissioners of Her Majesty's Treasury, pointing out the advantages of a decimal system of computation. They urged the great importance of uniformity in measures, weights, and coins in different countries, as increasing international commerce and facilitating scientific research, and, with great justice, argued that if any change were to be made it would be desirable at once to adopt that which would bring us into direct communication with foreign nations, thus obviating the inconveniences of a second change. They alluded to the metric system of weights and measures, which had already been adopted by several of the nations of Europe. Complete sets of the measures, weights, and coins of this system were sent by the Government of France to the Great Exhibition, one of which was purchased by Mr. Henry Johnson, and presented to this Society, in whose museum it still remains.

Up to this time the metric system was but little heard of or understood in this country, but having been thus and with such authority introduced to the notice of the public, it may be well to consider what claims it has upon our attention above other systems, and what was the cause of its popularity amongst a body of men who could have no motive in recommending it but the progress of social improvement and the real interests of the public.

What then is the metric system of weights and measures, and how came it to be first introduced?

Long previous to the French Revolution the confused state of the ancient weights and measures in France had attracted attention, and efforts were made to reform them. But it was not till 1790, when the Constituent Assembly passed a resolution desiring the king to obtain the co-operation of the English Legislature for the determination of a natural unit for weights and measures, that the question began to be vigorously taken up. It was at first proposed that an equal number of Commissioners from the Academy of Sciences and our Royal Society should meet and ascertain, at some suitable parallel of latitude, the length of the seconds pendulum; but this proposition was not agreed to, and the French Academy proceeded by themselves. They decided that all the multiples and subdivisions should be decimal; and that the units of surface, capacity, and weight should all depend on the unit of length. Commissioners were appointed, comprising the names of the eminent mathematicians Lagrange, Laplace, Borda, Monge, and Condorcet, to discuss the whole question. To get rid of the objections of national prejudice, they eventually decided to take a unit deduced from the dimensions of the earth, as being of universal application. They fixed that the unit of the whole system should be the ten-millionth part of the arc of the meridian between the equator and the North Pole; and in order that no doubt of its accuracy should be entertained, a new measurement of the earth was undertaken, to be conducted by the astronomers Delambre and Mechain. These geodesical operations were carried on for a period of ten years, and the personal adventures of the savants and their assistants, amidst the passions and prejudices of a sanguinary revolution, and in countries desolated by war, would make a volume of exciting interest. The arc to be measured extended from Barcelona to Dunkirk, and was afterwards prolonged to Fromentera, one of the Balearic Isles, near the coast of Spain. When the measurement was completed, delegates were invited from all the nations of Europe, including Great Britain, to assist in the reduction of the calculations, and decide on the several units of capacity and weight. The rivalries of war, unhappily, prevented this country from joining in this work of peace,

but representatives from the Netherlands, Sardinia, Denmark, Spain, Switzerland, and several states of Italy attended. The charge frequently made against the metric system, that it is merely national and peculiar to the French, is thus completely refuted. Though originating in France, and perhaps facilitated by the overthrow of ancient usages and local prejudices, it was proposed to the whole world, in the interests of commerce and science in general, and all nations were invited to discuss and agree to a common system.

The result of these deliberations was the fixing definitely the exact length of the metre. The square of ten metres, or 100 square metres, was made the standard of surface measurement, and called the "are." The cube of a tenth part of the metre, or cubic decimetre, was the standard measure for liquids, called the "litre." The weight of a cubic centimetre of distilled water at its maximum density was the standard for weight, and called a "gramme." We may leave out the "stere," used as the unit for solidity, which was a cubic metre, as not being required for international purposes. It was used in France for measuring the solid contents of stacks of firewood.

Such being the units, all derived from the "metre," the next step was to simplify the nomenclature of the multiples and subdivisions. This was done by prefixes, which are not French, but derived from the dead languages, taught in the schools of all countries, all the multiples being denoted by Greek, and the subdivisions by Latin prefixes.

	GREEK.		
Thus,	Deca...	... was used for	10 times.
	Hecto	... ,,	100 ,,
	Kilo ...	... ,,	1000 ,,
	Myrio	... ,,	10000 ,,

For the subdivisions the prefixes were :—

LATIN.	
Deci.....	for $\frac{1}{10}$th part.
Centi	$\frac{1}{100}$th part.
Milli	$\frac{1}{1000}$th part.

These being prefixed to the respective names for each unit of length, surface, capacity, and weight, the whole system was complete. In acquiring it the memory is taxed in the smallest possible degree, and it is, as a system of weights and measures, in all respects a marvel of simplicity and perfection. If this could be brought into universal use, all the complicated and numerous tables taught in the schools of different countries might be swept away, and the following brief table, common to all nations, be substituted in their place :—

	Length.	Surface.	Capacity.	Weight.
Myria ...	10000	...	...	10000
Kilo	1000	...	1000	1000
Hecto... ...	100	100	100	100
Deca	10	...	10	10
UNITS.	Metre.	Are.	Litre.	Gramme.
Deci	·1	...	·1	·1
Centi... ...	·01	·01	·01	·01
Milli	·001	...	...	·001

Whatever objections may be made to the use of the learned languages for names which are to be learnt and most extensively used by the poor and the ignorant, there can be no doubt that they give the greatest facility in acquiring the system. In any country in which this system is introduced, even if the old names of the nearest corresponding weights and measures should in popular use be applied to the new, it is very desirable that, in public and private schools, the original nomenclature should be taught, as the means of firmly fixing in the memory, with the least expenditure of time and labour, the entire system.

The advantages which this system possesses over others are almost visible on the mere inspection of the above table.

1. Its extreme simplicity. The learner has only to make himself acquainted with the dependence of the three units upon the metre, the basis of them all, and the prefixes, decimally increasing or decreasing values. There is nothing more to learn. By this simple process we get rid of the necessity of committing to memory all the cumbrous tables of weights and measures, which harass the minds of youth, take up so much of the valuable time of early life, and yet practically leave little behind that is useful thereafter. From an inquiry made amongst schools, by Mr. James Yates and Professor Leone Levi, it was ascertained that for a boy to learn our present system of weights and measures, with all the branches of arithmetic thereon depending, would occupy nearly three years, whereas the probable time for a decimal system would be less than ten months.

2. Its decimal character. However ingenious may be some of the schemes propounded, and whatever advantages the duodecimal system may possess by the greater number of divisors, there is a growing feeling amongst all practical and commercial men, and in all countries, in favour of decimalizing the weights, measures, and coins. The power of rapid calculation, and the vast saving of time and labour, the use of tables of logarithms, which, if all fractions were decimal, could be readily applied to commercial computations, are a set-off against the greater facility of division by the present scale. In decimal fractions there is no difficulty in taking the $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$th, &c. It is in division by 3 and its multiples that the recurring decimals principally arise, but in business transactions these could always be taken to any desired approximation. All actuaries are in the habit of making their money calculations by decimals of a pound sterling, in which this difficulty is constantly met. But the difference of taking the next higher or lower figure is too small to be appreciated. The advantages of the decimal character of the metric system are admitted by many whose objections are only against the use of an international system as causing more changes than are necessary in the interior trade of this country.

3. I think, however, we may be prepared to admit that, considering the vast increase in our foreign trade, and the constant removal of restrictions on freedom of commerce, some sacrifices may justly be made of national prejudices, and even temporary inconvenience endured, to obtain a system of weights and measures in common with a large part of Europe and America. One of the greatest recommendations of the metric system is that it is a final one, and that it is international. All other changes, however great improvements they may be on existing systems in any country, leave something to be desired, unless they also tend to bring nations together and facilitate their intercourse. Any country adopting the metric system finds itself at once in direct relation with several important countries which have already taken the final step, and the united population of which cannot amount to less than 120 millions.

If the plan were not even so perfect as it is, it would be expedient and wise to adopt a system common to so many, rather than remain isolated and obstructive in a matter in which the interests of commerce are so much concerned.

It will be well to take a glance at the progress which the metric system has already made in the countries in which it has been wholly or partially adopted.

FRANCE.—The circumstances under which the metric system was introduced into this country, naturally prolonged the period of its trial before it could be made compulsory. The Board of Works adopted it from the beginning. The officers and shipbuilders in the naval arsenals used it by the permission or rather by the authority of the Government. But for a long period it was permitted to the people to continue their old system, and we know how difficult it is to eradicate ancient prejudices and to make popular even real improvements until a new generation has learnt and practised them. Napoleon, for many reasons, allowed the usages of the old monarchies, and did not press on the people what had

been introduced during a revolutionary period. The restored Bourbons also could not be expected to look with much favour on a system devised and introduced under the Republic. Thus the old system continued to be legal long after the new one had become known, and some confusion was the result. But under Louis Philippe, a law was passed, in 1837, providing for the full establishment of the metric system in 1840, and since then it has rapidly grown in favour, though the people still give, in some cases, the old names to the nearly equivalent values in the new system.

BELGIUM.—The French originally introduced the metric system into this country when they got possession of the Austrian Netherlands. The French nomenclature was changed when Belgium became united with the Dutch Netherlands, but again restored by a law passed June 18, 1836, after she recovered her independence in 1830. But it was at a later period, by a law dated October 1, 1855, that the verification and the form and series of weights and measures were definitively regulated. The series, both for weights and measures of capacity, was then represented by the figures 50, 20, 10, 5, 2, and 1, and the same with regard to money, so as to obviate the objection that the series was not sufficiently subdivided for the ordinary purposes of business. A law of July 9, 1858, further enforced the use of the unit of the metric weight, the gram in prescriptions and sales in chemists' shops. Although in some operations of business, as in the sale of stuffs, the ell is used, and although in the country peasants still keep in some places to the ancient measures of land, yet amongst the population generally the metric system is fully introduced. Not only is it exclusively employed in public documents, in the markets, in commercial operations, and in manufactures, but in every register and commercial writing, whether for wholesale or retail business, the francs and centimes and the metric weights and measures are exclusively employed. I owe this recent information of its progress in Belgium to M. Visschers, the distinguished social reformer, who gave evidence when in London before Mr. Ewart's Committee.

HOLLAND.—In 1816 the metric system was introduced, and became law in 1819. But the former Dutch names were used for the nearest corresponding weights and measures, with the addition of the word "new," to distinguish them from the old. It is enforced in all commercial dealings, except in weighing medicines, in which we should have thought (as is admitted by the chemists of this country) its precision and minute subdivisions would have given it peculiar claims to be recognised.

SWITZERLAND.—In this country a double system prevails, the German and French elements causing some opposition. Proportionate parts of the meter are used for the measures of length, the foot being 0·3 meter and decimally subdivided, and the unit of road measure being 4,800 metres. The unit of weight, also, is the half-kilogram, or 500 grams, but not decimally divided. No doubt the further improvement of the system here awaits the changes which Germany yet has to make.

SPAIN.—By a law of the 19th July, 1860, the metric system was to come into force on 1st January, 1859, although for part of the kingdom it commenced in 1853. The system was also extended to Spanish America and Cuba. Even so far back as 3rd January, 1851, the meter was ordered to be used in all announcements of sales of the national property. Count de Ripalda, who has taken an active part in the different statistical congresses in London and abroad, states that the Government are sincerely anxious for its full enforcement. The engineers, the artillery, the military and marine departments, have adopted it. The sales of houses and lands, and the public domains are made by hectares and square meters. The government has purchased 600 collections of standards, and is about to purchase more, that every large town may have the means of verifying the weights and measures in use. On the railroads the goods traffic is charged by kilometers and kilograms. Ships are about to be measured by the metric ton. Tables of the old measures, with the reduction into those of the metric system, from 1 to 1,000, have been published by authority. To this it may be added that within a few months an advertisement appeared in an English journal, from the Spanish Government, for tenders for the manufacture of no less than 80,000 pieces in the metric weights and measures, for the supply of the interior and of the colonies. These proposals, it is thought, will be accepted by the French manufacturers.

PORTUGAL.—The metric system was established by law in 1862, and a special department formed for carrying it into force. At the International Statistical Congress, held in Berlin last autumn, the Marquis d'Avila, the delegate from Portugal, gave an account of its progress in that country. By a decree of 14th December, 1852, the metric system was declared compulsory, ten years afterwards, throughout the whole kingdom. The Government had power to fix the successive periods at which the various parts of the system should come into force, which was not till six months after the respective standards had been distributed, and the necessary tables for reduction had been published. A Central Commission was charged with these preparatory labours. The Secretary of this Commission, S. Fradesso da Silveira, was authorised to purchase standards, verified at the Conservatoire des Arts et Métiers of Paris, and to study the practical working of the system in France and Belgium. His mission having terminated in 1855, special agents were sent throughout the country to make a comparison in each commune, with the aid of the municipality, between the old and the new standards, and a verified report of the results was deposited with the authorities, and also sent to the Central Commission. An elaborate government publication not only contains the tables of all these results, but the tables of reduction of all the old measures into the new metric measures, and *vice versâ*, and the same for all the units of English and Portuguese measures. The General Department of Weights and Measures, which took the place of the Central Commission, made provision for teaching the new system of weights and measures in all public and private schools. The consequence of this active and zealous introduction of the system was that, instead of the ten years originally prescribed, the Government felt justified in ordering the new system, as to measures of length, to be enforced from 1st January, 1860, and as to weights to commence from 1st July, 1861. For the service of the Custom-houses, a law of 30th June, 1860, authorised the Government to publish a new tariff of duties in accordance with the new system, which was done in the same year, and the official statistics have since been given in terms of the metric system. The preparatory labours for the introduction of the metric measures of surface and capacity are already completed, and the whole system will in a very brief period be in full operation.

GREECE.—The metric system was introduced by the law of 28th September, 1836, but the nomenclature is Greek. For weight, the unit called the mine is 1½ kilogram, and the talent has 100 minen, or 150 kilogrammes.

ITALY.—In Sardinia and Lombardy the metric system has long been established, and since the union of the Neapolitan and other Italian states, the system is rapidly extending over the whole kingdom.

AUSTRIA.—The half-kilogram, decimally subdivided, has been introduced in the collection of customs, and in the steamboat and railway traffic, without producing any inconvenience, and the florin is subdivided into 100 kreutzers instead of 60. His Excellency, Baron von Czoernig, President of the Central Statistical Commission, reports that they are preparing for the introduction of the metric system in its entirety.

GERMANY.—As to the other states of Germany, a conference was held in 1860, at Frankfort, at which representatives from nearly all the German powers were present, and after a careful consideration of the whole subject, they recommended the introduction of the metric system, as

the best system of weights and measures for all Germany. At the International Statistical Congress, held in Berlin, in September last, very strong resolutions were passed, both in the section which was specially devoted to this discussion, and in the congress itself, strongly recommending the metric system to be authorized by law in every country not now using it; that an International Commission should be formed, to further its universal adoption; that it should be made compulsory in the shortest practicable period; that each government should institute a department of weights and measures to carry out the details of its introduction; and that wherever it is made permissive only, it should at once be legalized in the customs, and taught in all the schools over which the state has any authority. As these resolutions were the result of a discussion in a section specially set apart for this purpose by the Preparatory Commission of the Prussian Government for the regulation of the Congress, there can be little doubt that Prussia, although not represented at the Frankfort Congress on this subject, will not be behind the rest of Germany in this important reform of her existing system.

RUSSIA.—Since 1858 considerable interest has been excited by the appointment of a Commission of the Imperial Academy of Science, whose report is in favour of the entire introduction of the metric system into the empire. M. Kupfer, the reporter of that Commission, who attended as a delegate from the Russian Government, at the meeting of the International Decimal Association held at Bradford in 1860 (and at which M. Michel Chevalier, the enlightened and eloquent advocate of free trade in France, presided), assured the meeting that if Great Britain would take the lead Russia was prepared to follow, and wholly adopt the metric system.

SWEDEN, NORWAY, AND DENMARK.—A new decimal system of weights and measures was introduced into Sweden in 1855, to be compulsory from the 1st January, 1863. But Mr. Ewart, in his able speech on the introduction of his bill before parliament, 1st July, 1863, stated that, at an important Scandinavian meeting for Political Economy, held on the 20th May preceding, at Gottenberg, at which nearly 500 persons, including members of the Swedish, Norwegian, and Danish Parliaments were present, a resolution was passed that it was expedient to adopt the pure metric system, both for measures, weights, and coins, in all the Scandinavian countries. Since then the late King of Denmark appointed a commission to study and report on the question.

Besides these remarkable testimonies to the rapid progress and popularity of the metric system on the continent of Europe, we find it making an entrance into South America, by being introduced into Chili in 1848, in lieu of the old Spanish system.

Can we suppose, then, that Great Britain, claiming to be the foremost nation of the earth in social progress, in education, freedom of thought, and commercial enterprise, and to whom, on the latter account especially, any system which could get rid of the incongruities and confusion of her present system would be a peculiar boon, cannot accomplish what has been so easily effected by other nations? Is it to be believed that we are unwilling to encounter some temporary, even though great inconvenience, in order by one bold change to come at once into that great community of different nations which we have enumerated as possessing or taking active steps to possess a common system of weights and measures so convenient for their internal trade and the interchange of their productions with other countries?

Few perhaps are aware of the silent but continued progress which has been made within a few years towards preparing the public of this country for the introduction of this system, and of the extent to which its advantages have been recognized. I proceed briefly to state a few leading facts; time will not permit the full details, nor to consider at present so fully as they deserve the other propositions advocated.

Commencing with the Great Exhibition of 1851, I have already mentioned the steps taken by the Society of Arts to draw the attention of the Government to the importance of a uniform and general system. Since then, from the earnest desire of the Council to promote the great objects of the Society, by giving facilities and encouragement to commerce, this hall has been frequently opened for discussions on this subject. The members of the International Decimal Association have met the delegates of the Institutions in Union at a special meeting, and debated the question fully. This was the more important, as the delegates, coming from all parts of the country, and representing the leaders of the industrial classes, would carry back their new ideas to be again discussed in their institutions throughout the kingdom, by the very class who suffer most under the anomalies of the present system, and would be the first to have to bear the inconvenience of a change. Yet the expressions of the speakers were almost unanimous in favour of the metric system, as being a change, although great, final in its effects.

Again, the Council of this Society have, on other occasions, granted the use of their room for the delivery of a series of lectures by Mr. Fellows, Mr. Hennessy, M.P., Mr. R. G. Williams, Mr. Yates, &c., on the inconveniences of the present system, the impediments to the introduction of the metrical system, and the legal and educational questions involved therein. These lectures were well attended, and very numerous invitations were sent out, and the proceedings well reported in the metropolitan and provincial papers.

I trust also that my feeble introduction of the subject this evening will be forgotten in the animated debate, by which the Council will feel their efforts to promote the interests of the public amply rewarded.

The most important step towards popularising the question was the formation of the International Decimal Association, which was formed at Paris in 1855, after the Statistical Congress that had just been held there, and when the jurors and other influential persons attending the Universal Exhibition then at Paris were able to attend. No less than 150 persons of high intellectual or social position, interested in manufactures or commerce, were present, and the meeting was presided over by Baron James de Rothschild, the head of the greatest European banking house, whose pithy and eloquent speech summed up in the fewest possible words the advantages of a common system of weights, measures, and coins throughout the world. The Association then formed owed its origin principally to the efforts of Mr. James Yates, F.R.S., and the influential support of that public-spirited nobleman, the present Earl Fortescue. It is meant to be European, and to have branches in every country, but it is to the English branch, then established, that the growing interest of the public in this question is mainly due. Since then, no opportunity has been lost, by pamphlets, lectures, discussions, petitions to Parliament, deputations to the government on all suitable occasions, at Statistical Congresses, at the meetings of the British Association or Social Science, at the Statistical Society and Institute of Actuaries, at the Chambers of Commerce, at Mechanics' Institutes, by interesting men of all classes and opinions, to promote a free inquiry into the question of unity of weights and measures, not for this country only, but one common to all other European nations. It would be interesting to trace all that has been done since the period of the Great Exhibition of 1851, but time and space do not permit, and we must briefly rest at the stage at which we have now arrived—Mr. Ewart's Committee and its consequences.

The Committee was appointed to inquire into the practicability of establishing a uniform system of weights and measures, with a view to facilitate our domestic and foreign trade. It was fortunate for the latter part of the inquiry that the Committee was sitting during the International Exhibition, when a number of foreign witnesses,

men of science, merchants, and manufacturers, could give evidence of the improvement which the metric system had effected in other countries, and how the difficulties of introducing it could be overcome. The inquiry was eminently practical and the conclusions unanimous.

The recommendations of the Committee were as follows:—

1. That the use of the Metric system be rendered legal, though no compulsory measures should be resorted to until they are sanctioned by the general conviction of the public.

2. That a Department of Weights and Measures be established in connection with the Board of Trade. It would thus become subordinate to the Government, and responsible to Parliament. To it should be intrusted the conservation and verification of the standards, the superintendence of inspectors, and the general duties incident to such a department. It should also take such measures as may from time to time promote the use and extend the knowledge of the Metric system in the departments of Government, and among the people.

3. The Government should sanction the use of the metric system, together with our present one, in the levying of the customs duties; thus familiarising it among our merchants and manufacturers, and giving facilities to foreign traders in their dealings with this country. Its use, combined with that of our own system, in Government contracts has also been suggested.

4. The metric system should form one of the subjects of examination in the competitive examinations of the Civil Service.

5. The gram should be used as a weight for foreign letters and books at the Post-office.

6. The Committee of Council on Education should require the Metric system to be taught (as might easily be done, by means of tables and diagrams) in all schools receiving grants of public money.

7. In the public statistics of the country, quantities should be expressed in terms of the Metric system in juxtaposition with those of our own, as suggested by the International Statistical Congress.

8. In private Bills before Parliament the use of the Metric system should be allowed.

9. The only weights and measures in use should be the Metric and Imperial, until the Metric has generally been adopted.

10. The proviso in the 5th and 6th William IV. c. 63, s. 6, should be repealed.

11. The department which it is proposed to appoint should make an Annual Report to Parliament.

In accordance therewith a deputation, including several Members of Parliament, Mr. Ewart, Mr. J. B. Smith, Col. Sykes, and others, waited upon the Right Hon. Thos. Milner Gibson, President of the Board of Trade, but finding as the result of the interview that her Majesty's Government were not prepared to introduce or support a Bill which would carry out the recommendations of the Committee, the Council of the International Decimal Association, with the support of the associated Chambers of Commerce and other public bodies, respectfully requested Mr. Ewart to introduce a Bill for that purpose. Strong reasons, however, were thought to exist against a merely permissive Bill, which, besides adding another to the many systems already in use, would allow all those who were unwilling to incur the expense and trouble of the change, or who objected to its being taught in schools or used in Government departments to prolong almost indefinitely the period for its general adoption. The original draft was therefore altered to one which made the metric system compulsory after three years, allowing the intervening period to prepare for the change, as we have seen has been the course in the legislation of other countries. On the 1st of July last, on the second reading, a very animated and interesting debate took place. Mr. Ewart made an eloquent and powerful speech, and was supported by Mr. Locke, Q.C., Mr. Pollard Urquhart, Mr. Adderley, Mr. Baines, Sir M. Farquhar, Bart., Mr. Cobden, Mr. Bazley, Mr. Roebuck, Mr. R. Hodgson, Mr. J. B. Smith, Mr. Griffith, and Col. Sykes. The opponents were Mr. Henley and Mr. Hubbard. Mr. Milner Gibson, opposed the Bill on behalf of Government, on the ground that the people were not prepared for so great a change. The Chancellor of the Exchequer also objected to the compulsory character of the Bill and some other members would have preferred a permissive Bill. Though the metric system was approved by the second reading being carried by a majority of 110 to 75, it was considered by Mr. Ewart prudent to defer to the opinions so expressed, and it is hoped that he will, early in the approaching session, introduce such a measure as will secure the favour of the House, and allow the people of this great commercial country to become familiar at least with the merits and advantages of the metric system in actual practice. It is already used in some trades. Machine-makers, engineers, chemists, bear this testimony to it. If once rendered legal, it is only a question of time how long the existing state of confusion, comprising ten legal systems of weights and measures, will remain. "Decimal grains, used for scientific purposes; troy weight, under 5 Geo. IV., c. 74; troy ounce, with decimal multiples and divisions, called bullion weights; bankers' weights; apothecaries' weight; diamond weights and pearl weights, including carats; avoirdupois weight, under 5 Geo. IV., c. 78; weights for hay and straw; wool weight, using as factors 2, 3, 7, and 13; coal weight;" would all give way to one simple and definite system, applicable and convenient for every trade transaction, large or small.

The information given before the different Parliamentary Commitees, on the customary weights and measures in different localities, would be amusing, if it was not so serious and obstructive to internal trade. Soon after the British branch of the International Decimal Association was formed, it was resolved to collect information as to the variety of weights and measures in use in different parts of Great Britain.

"For this end, a circular was sent to municipal bodies, mechanics' institutions, chambers of commerce, and agricultural associations throughout the country. The returns, classified in a table published by the Association, exhibit a very remarkable view of the discrepancies which are found in different localities of weights and measures under the same name. The linear measures of land, for instance, differ from 3 feet, used at Hertford, to the chain of 66 feet, used at Hastings, and include between these limits seventeen different measures in different places. In superficial measures of land, twenty-five varieties exist; and the acre itself varies from 4,840 square yards to 10,240 square yards. Wheat, oats, and barley appear to be sold indiscriminately, by weight or measure, the bushel undergoing all sorts of changes in quantity, and giving place in some districts to the load of 3 or 5 or 40 bushels, of 5 quarters, 144 quarters, or 488lb—to the bag, the stack, the boll, the comb, the windle, the hobbet, the strike, the stone, the barrel, the winch, all differing from each other. For the sale of butter there is the pound, which has in different places 16, 18, 20, 24 ounces, besides the pint, the dish, and the roll. Potatoes, pork, flour, and coals are variously sold by weights or measures having no relation to each other. The measure of timber and brickwork would be equally unintelligible to inhabitants of different localities; and in wool and flax the stone differs from 16 to 24½lb."

Professor Leone Levi also says:—"For measures of length we have the ordinary inch, foot, and yard. In cloth measure, we have yards, nails, and ells. There are four different sorts of ells. For nautical purposes we have fathoms, knots, leagues, and geographical miles, differing from the common mile. The fathom of a man-of-war is 6 feet; of a merchant vessel, 5½ feet; of a fish-

ing smack, 5 feet. We have also the Scotch and Irish mile, and the Scotch and Irish acre. There are several sorts of acres in the United Kingdom, and there are a great variety of roods. We have in almost every trade measures of length specially used in these trades. For the measurement of horses, we have the hand; shoemakers use sizes; and we are compelled to adopt gauges where the French use the millimetre. The gauges are entirely arbitrary. The custom of the trade is the only thing which would decide the question in case of dispute. For measures of capacity, we have twenty different bushels. We can scarcely tell what the hogshead means. For ale, it is 54 gallons; for wine, 63. Pipes of wine vary in many ways; each sort of wine seems to claim the privilege of a different sort of pipe. For measures of weight, we have about ten different stones; a stone of wool at Darlington is 18 lbs., a stone of flax at Downpatrick is 24 lbs., a stone of flax at Belfast is 16¾ lbs., but it is also at Belfast 24½ lbs., having in one place two values. The cwt. may mean 100 lbs., 112 lbs., or 120 lbs. If you buy an ounce or pound of anything, you must inquire if it belongs to Dutch, troy, or avoirdupois weight."

It is true that such discrepancies exist in defiance of existing laws, but they will never be effectually put down till one simple system is taught in schools, and a new generation has grown up after the old systems have been abolished.

Though the metric system appears to be in all respects distinct and opposed to our own, there are several points in which it would nearly accord with existing weights and measures. A meter, which is the basis of all, corresponds to 39·37 English inches, about 1 1/10 yard; 1 pole or perch (5½ yards) = 5·029 meters, about 5 meters; 1 furlong (220 yards) = 201·165, about 200 meters; 5 furlongs = 1,005·822, about 1 kilometer; 1 foot = 3·048 decimeters, about 3 decimeters; the are = 119·5 square yards, nearly 120; the liter = 61·03 cubic inches, or 2·1135 wine pints, nearly 1 quart; the gram = 15·434 grains; the kilogram = 2·205 lbs. avoirdupois; the half-kilogram = about 1 lb.; the ton = 1,015·65 kilograms, say 1,000.

Our exports to countries using the metric system have increased from £23,696,000, in 1847, to £55,242,000 in 1861, an increase of 133 per cent., whilst to countries using the English system they increased only from £16,262,000, in 1847, to £24,211,000 in 1861, or less than 50 per cent. increase.

If the metric system be once legalised in this country we can hardly form an estimate of the immense benefits that would follow to the commerce of the world. Our colonies would naturally, and for their own sakes, adopt the system of the mother country, with whom their trade principally lies. India, which has no common system of weights and measures, but, under the varieties of native governments, is full of incongruous and absurd systems, by which it cannot be doubted the labouring classes especially are exposed to false weights and trade frauds, might by our influence gradually find one simple system prevailing throughout the whole of those vast dominions. The Americans, who have long agitated this question, would not, we are assured by the American delegates who have been sent to our European congresses, hesitate to make the change. They are only deterred now by the disturbance that would arise in their large trade with this country as long as our present system continues. An impetus would be given to Russia and Germany to complete the work to which they are already half committed.

The expression in the old English statute "that there should be but one measure and one weight throughout the land," might be expanded into the grander idea, which would then be almost realised, that there should be but "one measure and one weight throughout the earth." Commerce, the real harmonizer of nations, uniting them in the bonds of mutual interest and growing esteem, would then receive a still greater development than has occurred even in the last few years, diffusing everywhere the blessings of peace, and causing all nations to pause ere they precipitated each other into the calamities of war.

DISCUSSION.

The CHAIRMAN having expressed his personal obligations to Mr. Brown for having introduced a paper on a subject on which that gentleman had had so much experience, in relation to the commerce of different countries, remarked that a great aid to the progress of the metrical system on the continent of Europe had, no doubt, been afforded by the rapid extension of the railway and steamboat system, which so greatly facilitated intercommunication. Treaties of commerce had lately been entered into between England and France and other great nations, and the ministers who met together to negotiate those treaties must have experienced considerable difficulty in arranging the details, owing to the weights and measures being so very different in the countries they represented. Another means of the extension of the metrical system was, no doubt, to be found in the recent abandonment of the passport system on the Continent, a sure sign of the modification of the old selfish policy which had so long existed in different nations. With regard to the English system of measurement, if we looked to its origin, and to the mode in which its basis, the inch, had been arrived at, it was remarkable how unscientific it was. The definition of an inch in the table-books was "Three barleycorns, one inch." The three barleycorns were taken from the middle of an ear of barley as yielding the best specimens of that grain, and the inch, multiplied by 12, was taken to constitute the foot measure. That measure could not have been originally taken from the length of the foot of a man, which, in a person of the ordinary stature of 5 feet 10 inches, did not generally exceed 10¾ or 11 inches. He thought little would be lost by the abandonment of the present system of weights and measures in this country, whilst the advantages of a decimal system were evident. Mr. Brown had shown how much time would be saved in the education of the young, if a simpler system than that now in use were adopted, and Mr. Chadwick, who had gone very deeply into this question, had expressed his opinion that a child educated under the improved system would save one-third of the time at present occupied in mastering the numerous tables and rules now found necessary. Englishmen might be regarded as wharfingers and warehousemen to the rest of the world. We had wharves everywhere, and the flag of this country floated in every quarter of the earth, and no doubt our trade would be greatly facilitated if an universal system of weights and measures were introduced. He had no doubt of the ultimate success of this movement; the only question was the time that would be occupied in effecting it. The only other proposition worth consideration was that we should decimalize our existing weights and measures, but he thought there would be no great advantage in simply altering the foot measure from twelve inches to ten inches, as this would not aid in assimilating our system to that of other great countries. It was a remarkable circumstance that no body of men were more anxious for the proposed change than the chemical profession. The Pharmaceutical Society were amongst the most zealous supporters of the metrical movement. At the meeting of the British Association in Newcastle last year, the subject was brought under the consideration of the chemical section, by whom the following resolution was passed:—"That, in the opinion of this committee, the uniformity of the standards of weight and measure in use throughout the civilized world is a matter of greater importance than the decimal division of the standards now in use, and that the French metrical system is that which is best adapted to the present state of science." The most distinguished persons were upon that committee, and they must be deemed good authorities on the subject. Throughout the whole of Germany the metrical system was held in the highest favour, and in all the aspirations for German unity the idea of uniform weights and measures was a leading feature.

Mr. JAMES YATES, F.R.S., regarded education at the present moment as the best means of introducing the

metrical system, and in directing his attention to that object he had arranged an educational apparatus, which appeared to him eminently adapted to impart a practical knowledge of the subject. It consisted of, 1. An abacus, suited for teaching decimals, together with whole numbers, to the youngest children; 2. A table of arithmetical signs, including the decimal point; 3. A metre, divided into decimetres, centimetres, and millimetres; 4. A centiare, or square metre, for explaining superficial measure; 5. A cubic decimetre, showing its division into 1000 cubic centimetres; 6. A synoptic table, showing all the principal measures and weights, with their derivation and their relation to one another. His plan was to bring before the learner's eye the actual weights and measures, and the system upon which they were divided, and though the object was more especially to teach the use of decimals, the principle was applicable to arithmetic generally. The present methods of teaching were, in his opinion, very defective, and capable of immense improvement. As to the metre, he had considered what would be the best method of teaching its use in schools, and for this purpose he recommended that a standard, accurately divided into the metre, decimetre, centimetre, and millimetre be employed. A measuring tape, having the English measurement on one side and the French on the other, was, in his opinion, a very good means of familiarising the mind with the relations of the metrical system to our own. The next instrument he proposed was the centiare, or the hundredth part of an acre, otherwise a square metre, which should be divided into square decimetres and centimetres. These instruments were useful in making clear to children measures of length and surface. Mr. Yates then proceeded to call attention to the synoptic table of weights and measures, which was similar to the one in general use in France, and which was being adopted in Portugal. For the preparation of this he was indebted to Mr. Dowling, C.E. On this table every one of the weights, measures, and lengths was drawn of the actual size. In one corner of the drawing there was a small representation of the earth, and that was placed there because the metre was the ten-millionth part of the quadrant of the earth from the north pole to the equator. An objection had been made that this was a fanciful and inaccurate standard. On the contrary, he thought it a grand and noble idea, for when it was desired to frame a system adapted to the whole human race, and when the object was to accommodate all the inhabitants of the earth, they could not do better than take the basis from the measurement of the earth itself. The greatest possible care was taken in the matter, and, notwithstanding the objections made to it, there was the greatest accuracy in that measurement.

Mr. WM. HAWES (Chairman of the Council) said there were two points of view from which this subject must be regarded, viz., the scientific and the practical. As far as science was concerned it was desirable that weights and measures should be assimilated all over the world. The idea was a large one, and might charm the mind of an enthusiast with the notion of an uniform measure leading to universal peace and amity among nations; but looking at the present state of the world, he must be very sanguine who thought such small matters could influence its destinies. It had been advanced, as a question of education, that it took a child three years to learn our present system. They were told that there was a great variety of distinct systems of weights and measures in use in different parts of this country, and they were asked to infer that a child was necessarily obliged to learn all those systems. But this was not the fact. It was only necessary for each child to become familiar with the weights and measures in use in his own particular district. He thought this question of education had been put forward too forcibly, and that the advantages of the decimal system in this respect had been unduly exaggerated. There were other points connected with the subject which well deserved serious consideration. If by Act of Parliament the adoption of the metrical system of weights and measures were made compulsory—of course money would be included—the lists of the prices current of articles would be placed in the greatest confusion, particularly when comparison had to be made with those of former periods, necessarily calculated upon the old system. It would be a serious matter to find ourselves suddenly obliged to transact the whole of our business on an entirely new set of formulæ. The amount of confusion would be so great that nothing but some absolute and practical good could justify such a change being made by Act of Parliament.

The CHAIRMAN remarked that it was intended to keep the pound sterling as the unit.

Mr. HAWES—It would not affect the pound, but the thousandth part of a pound would not be a farthing. This would alter the basis of many calculations. They had been told that the trade of this empire had increased more with those countries which used the metrical system than with others, but he could not allow that this was owing to the metrical system, but rather to other causes, such as commercial treaties and the introduction of free trade where prohibition had been the rule for centuries. The trade with France, from two or three millions had become eight or nine millions within the last three years. Had the metrical system anything to do with that?

Mr. BROWN explained that his argument was not that the metrical system had produced the increase of trade, but that owing to the increase of trade the assimilation of our system with that of other countries became all the more desirable.

Mr. HAWES thought there would be little or no commercial advantage in the introduction of this system. If a shipment of goods were to be made to France, it was easy to calculate the equivalents to the weights and measures of the respective countries. The whole matter was a question of arithmetic in the counting-house, and did not affect the profit or loss of the transaction. He began his observations by stating that, in a scientific point of view, this change of system might be desirable, but that was only a very small part of the question. He contended that the advantages put forth in the paper as likely to follow the change from one system to the other were greatly exaggerated, and that they were not worth the cost and confusion involved in the change. They had been told of the great facilities and advantages which arose from it in other countries, and yet he found that France, which had taken the lead in this question, required from 1790 to 1840 to bring the system into general use. Under what might be termed a despotic government, it took fifty years to bring about the change in that country, and in a free country like this a much longer time would be required. Many persons present were old enough to recollect the time when the ton, which was formerly so variable, was declared by Act of Parliament to be twenty cwt., and they also knew for how many years that Act was evaded. To introduce the metrical system as compulsory, he thought would be unwise—if it was beneficial it would introduce itself. A Society like this might point out the advantages of a permissive enactment, but let them not be too sanguine of its being generally or rapidly adopted. Its commercial difficulties were so great that he did not think that men of business would receive it with anything like encouragement.

Mr. OGILVIE said he would not have presumed to offer any observations on this subject if he had not had some experience of the working of this system. He thought the metrical system was practical and useful, easy to learn, and more easy in application. At the same time those who had had anything to do with introducing important changes of this kind were aware of the difficulties attending that operation. He thought this question should be viewed under two aspects, the international and the national. Under the existing facilities for the interchange of the productions of different countries, he believed the metrical system would be of great benefit to commer-

cial men, and he thought after a little education they might with great facility transmute one system into the other. He did not for a moment advance the Utopian idea that all these commercial relations would immediately produce an universal peace, but that would be the ultimate tendency of such a course. This question should also be viewed in its national aspect as regarded our home and domestic trade. They would find some difficulty when they came to the transactions of retail trades. In the multitudinous purchases made in the metropolis, on Saturday nights, if persons were compelled at once to make the change, a good deal of difficulty would be experienced. Again, there would be difficulty in establishing the universality of this system. Even now in France a difference existed in various parts of the country. In one part they stated the price of things in francs and centimes, and in another part in francs and sous. These difficulties of detail, he believed, would be ultimately overcome, and for these reasons he thought the metrical system would be useful, and ought, if possible, to be introduced into this country.

Dr. DE MESCHIN thought the practical advantages resulting from any new scheme should be looked at rather than the difficulties by which it was accompanied. Mr. Cobden had stated that he never knew a cause so much supported by the concurrent testimony of practical and scientific men as this one. He (Dr. De Meschin) admitted some of the difficulties Mr. Hawes had alluded to, at the same time he thought the resulting advantages would outweigh those difficulties. The decimals of the pound sterling were so well known in this country that he thought there would be no difficulty in that respect. With regard to the length of time that had been required for the full introduction of the metrical system in France, it should be remembered that the First Napoleon was very much opposed to modern ideas, and set his face against it at every opportunity.

Mr. F. LAWRENCE remarked that this question must be looked at, not as to the way in which it would assist the foreigner, but as to how it would benefit the people of this country. With regard to the commercial transactions of this country, would any one say that the French kilogramme offered greater facilities than the English pound weight? He considered the metrical system entirely founded on a mistake, in taking so small a standard as the gramme. In this country we had the pound and the ton, which were each suited to certain purposes. We must change the whole of our weights to assimilate them with those of France; and could it be said that our yard was not practically as good as the metre of France? They must also consider what would be the expense of this alteration in providing the new measures and weights throughout the country. He believed this would not cost much less than ten millions of money. What would be the advantage to consumers of gas to pay for it by the cubic metre instead of by the thousand feet? Did it facilitate calculation? Not at all. The present system was adopted in a staple trade of this country very much larger than the cotton trade—that was the iron trade. There they had tons, cwts., quarters, and pounds. There was great facility in this; because for every pound sterling in the price per ton there was a shilling per cwt. They had no such facilities in the metrical system, which, in that trade, would impede rather than aid calculation. This country had immense dealings with America and our colonies. He presumed, in Mr. Brown's statement as to the increase of trade, the transactions with our colonies were omitted. That statement led them to believe that we had larger commercial dealings with countries having the metrical system than with others. This was founded in error, because the whole of our colonies had been omitted. Our trade with America was five or six times as great as that with France. If we joined ourselves to France by the adoption of this system, we severed ourselves from America, which used the yard as a unit. The whole system, at first sight, looked very tempting, but he could not admit that there was any real advantage in deriving the standard from the measurement of the earth's arc. He thought this metrical unit was propounded by scientific radicals, whose only idea was to form a totally new system—to sweep away everything that existed and begin anew. The revolutionists in France not only swept away the old weights and measures, but they also swept away years and months from the computation of time, and, in that respect, they seemed desirous to begin the world anew. Although is was seventy years since the metrical system was introduced in France, it could scarcely be said, even now, to be in use for the every-day business of life.

Mr. FRANKLIN was glad that in any case the English sovereign would be retained as the unit of money in this country, inasmuch as it would be the best means of preparing the public for the alterations proposed in our weights and measures. The great question was how to make the masses of the public appreciate the advantages which this system promised. If they gave the workman the means of decimalising his money, it would prepare him for decimalising his weights and measures. If the objections hitherto advanced against the decimalisation of the coinage of this country were removed, the great obstacle to decimalisation generally would be got rid of, and then the public would be able to determine as between the established system and that which was substituted in its place. He thought it should be adopted from a conviction of its utility, and not made a compulsory Act in this country. Whatever they did he recommended them to keep the standard of the value of the coinage in their own hands. He hoped the International Association, by whom this subject had been so much ventilated, would be the means of paving the way to a better understanding of it by the public at large.

Dr. WADDILOVE said although he possessed no practical acquaintance with education or commerce still he could not but think that in a common-sense point of view it was desirable, if possible, that the metrical system should be introduced into this country. We had now a great variety of weights and measures throughout the kingdom, and he would put the simple question—supposing they were about to found a new colony and to introduce weights and measures into it, would they institute the incongruous system which at present existed in this country? He was satisfied they would not. Then, why should they maintain the present system? They were told it was difficult to alter it, and that great cost and trouble would be incurred in so doing. On one occasion we altered the "style," and there was a great outcry throughout the country on account of the innovation; but now we were reconciled to it and duly estimated its advantages. In like manner he believed they would eventually estimate the advantages of the metrical system.

Dr. FARR said two or three matters had arisen in the course of the discussion which seemed to require a few words of explanation. As a member of the International Decimal Association he felt very grateful to the Society of Arts for the opportunity thus granted of presenting the views of that association for discussion, and he believed that advantage would be derived from hearing the opinions of those who, like many present, had done much for the progress of industry both here and in other countries. As a statistician himself he would first speak of the application of the metrical system to statistical purposes, and he would say that the most eminent statisticians of Europe were agreed that it would be a great advantage if the statistics of a kingdom were expressed in the decimal system, and after a great deal of thought they decided that having a scientific system like that of the French in existence, it would be absurd to introduce a new one, even though more perfect, at the risk of its not being adopted by other countries. The French system was based upon certain units of convenient size, and they had subdivided those units decimally. His friend Mr. Hawes had very properly said they must have regard to practical utility in these matters, but it was found that

the practice of scientific men all over the world was to adopt certain units, and then decimalise them. In engineering it was found necessary to decimalise our weights and measures. Mr. Brown, being himself an actuary, found it convenient to decimalise the pound sterling; and the Astronomer-Royal had stated that all his observations were calculated upon the decimal system. The desire was to give to the commercial world the advantages which were now monopolised by the scientific world, and those, he submitted, they would enjoy under the French metrical system. Nobody could reasonably hope that the adoption of the metrical system would produce universal peace; but that it would tend to diminish the disputes between the commercial communities of different countries there could be no doubt, whilst it would certainly simplify all their business accounts. The grand reason why they were asked to alter their present absurd system of weights and measures in this country was that there was no simple relation between them. The system was not decimalised, and it would require as much change to decimalise from the yard as to introduce the metre and decimalise from it. He therefore thought it was desirable to accept the French system as a whole, for it was both scientific and remarkably convenient. It was true that those who established it did not adopt the then existing French unit, but there were a great number of units in existence at the time alluded to, and they adopted one which it was hoped the nations of Europe generally would agree to. With regard to our ton, it need not be disturbed, for the thousandth part of a ton was very near the kilogramme. They did not want more than two or three units in measure and in weights. For measuring roads they would take the kilometre, and for shop measurements the metre. He was persuaded that in the matter of education fully a year was wasted by the children in learning tables, many of which they forgot as soon as they left school. Mr. Hawes had raised a practical objection to this system in the matter of the quotations of commercial prices current, but they were not of any serious importance, as the differences were calculated approximately with but little difficulty, no error of any real consequence being involved.

Mr. HAWES said the small differences referred to by Dr. Farr would be an important matter in the profit or loss in a commercial transaction.

Professor LEONE LEVI briefly expressed a hope that the Society of Arts, from whom the International Association had hitherto received such valuable aid, would not withdraw its support from this movement. He suggested that the numerous publications on this subject should be as extensively circulated as possible amongst the Institutions in Union with the Society, as the best means of awakening consideration of the subject. Prizes might also be offered to teachers of schools who should pass an examination in the metric system, and the subject might be included in the annual examinations. The Society having already petitioned the House of Commons in favour of a universal system of weights and measures in this country, he hoped they would not retrace their steps, and when the measure was again brought forward by Mr. Ewart, next session, he should be glad to see the signature of the present Chairman of Council (Mr. Hawes) attached to a similar petition to that which was presented on a previous occasion.

Mr. BROWN, in reply upon the discussion, said with regard to Mr. Hawes's observations, they tended to the maintenance of any system, however cumbrous, which it was difficult to change. It was not proposed that this system or any other should be suddenly introduced and made peremptory. Whatever was done by the legislature or the public, it was expected that time should be allowed for proper instruction in and understanding of the system, and that when the public mind was prepared for the change they should have as perfect a plan as could be devised. Mr. Lawrence appeared to entertain an objection to the proposed change of nomenclature, but he (Mr. Brown) had no particular affection for this or any other nomenclature—only let the principle of the system be recognised, and he did not care how the sub-divisions were named. As to the introduction of the system by "scientific radicals" they might go further back than that for the origin of the scheme, viz., before the commencement of the revolution in France, but the knowledge of the subject was so advanced during the revolution that the people were better prepared than those of other countries to accept this scientific system. With regard to its effects upon our American trade, the Americans now traded largely with countries using that system, and a delegate from America had stated to the International Association that that country was prepared to follow England in the lead she might take in this matter. Therefore no fears need be entertained on those grounds. The same might be said of Russia and the whole of Germany. It was worthy of a country possessing the largest trade in the world to take the lead in this important step, and if England made the change it would influence a great many other countries to do the same.

The CHAIRMAN then proposed a vote of thanks to Mr. Brown for his interesting and valuable paper.

The vote of thanks was then passed.

The SECRETARY called attention to some specimens of fine zinc wire and zinc wire gauze, sent by Mr. James Spratt, the latter stated to be the first zinc wire gauze ever woven.

It was announced that on Wednesday evening next, the 3rd February, a paper by Mons. E. Vial (of Paris), "On Instantaneous Engraving on Metal," would be read. The paper will be illustrated by experiments.

The following letter has been received:—

SIR,—It is of great importance, when discussing the question of the policy of introducing a new system of weights and measures, that the facts stated should be accurate, and to be relied upon. I therefore append the exact figures as to the exports to countries in which the metric system is used, which are referred to in Mr. Brown's paper. In that paper it is stated that the exports to countries using the metric system had increased 133 per cent. from 1847 to 1861; and that the increase to countries not using it had only increased 50 per cent. The facts, however, which I extract from the same tables as those used by Mr. Brown, are that the exports to countries in which the metric system is entirely or *partially* adopted have increased from £23,600,000 in 1841, to £55,200,000 in 1861, or 133 per cent.: that the exports to countries where the English system is adopted have increased from £16,261,000 in 1841, to £24,200,000 in 1861, or 50 per cent., but (and this table Mr. Brown has omitted) the exports to countries where neither the English nor the metric system is in use, have increased from £18,880,000 in 1841, to £45,600,000 in 1861, or 150 per cent. Without questioning the accuracy of these figures, though, from a hasty glance, I think we should not all agree in the division adopted, I leave them for the consideration of your readers. —I am, &c., W. HAWES.

Proceedings of Institutions.

BACUP MECHANICS' INSTITUTION.—The twenty-fifth annual *soirée* of the Bacup Mechanics' Institution was held on New Year's Eve. The President (Lawrence Heyworth, Esq.) said it was with the greatest pleasure that he again appeared amongst them on the anniversary of their very valuable institution. He was there some 25 years previously or more, when the Institution was just commenced, and he was happy to say that he had been enabled to attend twenty-five times. That to him was a great gratification, but it was still greater to see the improvement in the population of the neighbourhood, which he accounted for in a great measure by the education im-

parted in that Institution.—Mr. Thomas Newbigging, the secretary, read the directors' report, which showed that the efficiency of the Institution had been maintained in all its departments. The directors, however, regretted that out of a population of 18,000 or more, only 340 should avail themselves of the advantages offered by the Institution. To the library had been added more than £60 worth of books. The issues during the year had been 6,439. The series of Wednesday evening lectures (21 in number), which terminated in March last, proved eminently satisfactory, and left a small balance in favour of the Institution. The average attendance at the day school was 204; there were on the books 240. A better attendance at the night school was desirable. The female classes were well attended, and the pupils were making progress. Twenty-four certificates, and prizes the money value of which was about £12, had been gained by members at the Society of Arts and other examinations during the year. The treasurer's account showed a balance in hand of £7 12s. 11d., the receipts for the year being £378 2s. 2½d. —Wm. Fairbairn, Esq., LL.D., said, after listening to the report, he had to congratulate them upon the means provided for the benefit of the members of the Institution. It was said that knowledge rightly applied was power, and so it was. He used the word "rightly" to show that all their attainments should be devoted to some useful purpose. A sound judgment united to goodness of heart was a reward which princes might envy. Success was the reward of industry, and gave them the pleasing reflection of having done their duty. Some people objected to too much work, but he believed they were more injured by idleness than hard work.—Thomas Lawton, Esq., agent of the Lancashire and Cheshire Association of Institutes, seconded the adoption of the report.—Barnett Blake, Esq., said it was impossible to conceive of a greater evil than that of a population growing up without any means of education after the limited tuition which they received at school. He would refer to Durham and Northumberland, which had been induced by the dictation of a trades union, without the least shadow of reason, to clamour for a higher rate of wages for the same amount of labour. The population of Lancashire and Yorkshire was greater than in any other part of the kingdom, and had suffered greater privations without complaining. That was the result of such institutions as those, which had taught men to reason and think rationally upon things. —The annual meeting took place on Wednesday evening, Jan. 6, for the purpose of electing officers for the ensuing year. Mr. Greaves occupied the chair. Various subjects of interest relating to the welfare of the Institution were discussed, and hearty votes of thanks were given to the different officers for their past services, and to the chairman for presiding.—An extraordinary general meeting was then held, and alterations were made in the rules with a view to providing that only one-half of the directors should retire from office annually, instead of the whole, as before.

BRISTOL ATHENÆUM.—A series of Monday popular concerts are being given here every week, much of the music being of a classical character. The prices of admission are—front seats, 1s.; second seats, 6d.

FARNHAM YOUNG MEN'S ASSOCIATION.—At the recent annual general meeting the election of officers for 1864 took place. The balance-sheet to December 31st showed that the expenses had been £125 15s. 3d., and that there was a balance due to the treasurer of £11 0s. 8d. The opening lecture of the second half-session, 1863-64, was delivered on Friday evening, January 15, by Rev. A. B. Alexander, of Reigate, subject: "Ants and Bees." The Lord Bishop of Winchester presided. The lecture was illustrated by a series of diagrams explanatory of the lives and habits, anatomy and physiology of the white and other ants, and the more common species of English bee.—A vote of thanks to the lecturer was passed, after some remarks on the subject by the bishop.

MOSSLEY MECHANICS' INSTITUTE.—On Wednesday, the 6th January, a lecture on "The Chemistry of Common Life," was delivered here by Dex Bean, Esq., who interspersed his remarks with a variety of interesting experiments. The chair was occupied by Mr. R. H. Buckley.

STALYBRIDGE MECHANICS' INSTITUTION.—A bazaar and art treasures exhibition has been held recently, to assist in clearing off the debt incurred in the erection of the new building. The Institution was first formed in 1825, having thus had an existence of more than thirty-eight years. It met at the commencement in a schoolroom, and continued there until the year 1858. Various efforts were made to obtain a new building, and in 1828, Robert Platt, Esq., promised to pay the difference between the rent of the schoolroom and more suitable premises. The committee at once accepted the offer, and removed to better premises, the beneficial effect of the change being felt in the acquisition of nearly 200 members in about three months. These premises were still too small, when, in 1860, Ralph Bates, Esq., promised to give £50 towards the erection of a new institution. Subscription lists were issued, and among the donations promised were £200 by Mr. Robert Platt, £200 by Messrs. T. Harrison and Son, £200 by Mr. John Leech, £150 by Messrs. Wagstaff and Co., £100 by Mr. John Cheetham, &c. In addition to these sums, Col. Astley gave the site for the building and £100 in money. This gift of Col. Astley was considered to amount to nearly £1,000. In July, 1862, the new Institution was opened. It cost £4,070, towards which about £2,000 (exclusive of the land) was raised by donations, and the remainder was borrowed. The debt on the building is thus about £2,000. The bazaar and exhibition remained open for a week, being opened and closed by the President, who in his closing speech said that probably since the Art Treasures Exhibition in Manchester, there had not been an exhibition in the north of England which had surpassed this one. The ironwork which had been displayed at the bazaar was really a splendid sight, and he believed no other bazaar had ever had a similar stall. It was completely cleared out.—The gross receipts were about £1,400, and the expenses would probably be £200, which would thus enable them to reduce the debt from £2,000 to £800.

Manufactures.

THE POTTERS' NEW DRYING CHAMBER.—It will be remembered that among the causes injurious to the health of the artisans employed in the manufacture of pottery, as insisted on in the report of the Commissioners appointed to report on this industry, that of the exposure to great alternations of temperature, in carrying and placing the ware in the drying rooms, was one of the most generally felt and complained of. The notoriously defective arrangements heretofore adopted have led to some few attempts to introduce better—attempts which were fostered by the prize offered by Mr. Elijah Jones. In the appendix to the Commissioners' report, plans are given of a potters' drying stove, as adopted at Messrs. Pinder and Co.'s works, at Burslem, from the design of Mr. Boulton. This form of drying stove presented great advantages over the rude arrangements generally in use; but still more simple and efficient drying rooms have been recently introduced at the works of Messrs. Minton and Co., Stoke, and Messrs. Liddle Elliot and Son, Dalehall, which entirely remove all the hitherto attendant evils of the drying process on the health of the workmen and boys, and at the same time facilitate the operation. The principle of these plans is a rotating cylinder, which in the one case is placed vertically, and in the other horizontally. Both are fitted with shelves, and inclosed in a chamber furnished with flues, so that a uniform heat is maintained at all parts. The cylinder is sub-divided into several sections, and is easily turned as required by the hand of the mould-runner, Each of these is filled in rotation with the greatest facility.

through an aperture for the purpose, and with very little escape of heat. Both are excellent inventions for their simplicity. Experience will, however, prove which of the two is most serviceable and most readily worked. These drying chambers may be seen in operation at the factories of Messrs. Minton and Co., and Messrs. Elliot and Son, who invite the inspection of all engaged in pottery manufacture.

SILVERING GLASS.—A process, said to be an improvement on *Foucault's*, for silvering glasses for telescopic purposes, has been invented by M. Martin, and both are on the same principle as Drayton's, which was rewarded by the Society in 1847. Martin makes use of four liquids, viz., first, a ten per cent. solution of nitrate of silver; second, liquor ammoniæ, sp. gr. ·970; third, a four per cent. solution of caustic soda; and fourth, a 12½ per cent. solution of white sugar, to which he adds ½ per cent. of nitric acid, and after twenty minutes' boiling he adds to it twenty-five parts of alcohol and water to make up the bulk to 250. The silvering liquid is made by mixing together twelve parts of solution No. 1, eight parts of No. 2, twenty parts of No. 3, and 60 parts of distilled water, and finally, in twenty-four hours, ten parts of No. 4. The object to be silvered is then immersed, when it will be covered with a film of reduced silver, which in ten minutes' time will be sufficiently thick for use. After having been washed with distilled water and dried, the surface may be polished with chamois leather and rouge.

CASHMERE SHAWLS.—The Maharajah of Cashmere is taking steps to check the further deterioration in the quality of shawls manufactured in his dominions; and with this view he has issued a circular to the manufacturers, with strict rules for regulating the manufacture. It appears that in Cashmere the number of men and women employed in the occupation of shawl-weaving aggregates 70,000, in fact, nearly all the inhabitants of that far famed city are connected with the trade. Owing to the dulness of the market in England and France, caused chiefly by the inferior description of shawls manufactured, many tradesmen and merchants have been subjected to heavy loss and some to bankruptcy, and a large proportion of weavers have been thrown out of employ. On the Maharajah's late tour through Cashmere the circumstance occupied his chief attention; and from the information he obtained he ordered a set of rules to be established in order to aid both manufacturers and traders.

DUBLIN EXHIBITION.—The prospects of the exhibition of Irish manufactures for 1864, in connexion with the Royal Dublin Society, are said to be most favourable. A guarantee, amounting to more than £8000, has been readily subscribed, and a meeting of the guarantors was held on the 22nd January, in order to appoint a finance committee. A report was read, giving an encouraging account of the response which the general committee had met throughout the country to their appeals for co-operation. It was anticipated that the exhibition would be well supported by the Belfast merchants, who came forward in a liberal spirit. The object of this display is to accumulate Irish manufactures only, and especially to show what progress had been made in Ulster with flax. A strong hope was expressed that this exhibition would be the means of developing the woollen and linen trades in Ireland.

Commerce.

BONELLI'S TYPO-ELECTRIC TELEGRAPH.—A practical demonstration of the working of this most ingenious invention was recently made before a party of scientific and other gentlemen interested in electrical subjects. The inventor of this telegraph is the Chevalier Bonelli, Director of Sardinian telegraphs, whose beautiful and ingenious electric loom was described before the Society in February, 1860, and this telegraph is in reality an adaptation of the same principle to the transmission of messages. The *modus operandi* of this telegraph is extremely difficult to make intelligible without either seeing the instrument at work or diagrams. The principle however on which it works is as follows:—The message to be sent is, at the transmitting end, set up in metal type, similar to that used for printing; there is a small, fine metallic comb, of five teeth, insulated from each other, and each connected by means of a separate wire, with five separate metallic points at the other end of the line resting on a chemically prepared paper, on which the message is to be received. Connection with the battery being made, the type is moved under the comb, the five teeth of which thus pass over it, making and breaking contact according to the form of each letter as it passes, and thus permitting the current of electricity to pass during each contact to the points at the other end, decomposing the chemicals, and marking the paper, which has a motion given to it similar to that of the type. Thus the form of the type becomes impressed on it, being made up of dots and lines of varying lengths, corresponding to the contacts of the five teeth with the surface of the types. The arrangement by which this result is produced may be thus described:—Let the reader suppose himself to be the operator; before him he will find an oak table, six or seven feet in length, seventeen to eighteen inches wide; along the centre of this table runs a miniature railway, terminated at each end by a spring buffer, and spanned midway by a kind of bridge, six inches in height and two and a half or three inches wide. Upon this railway is placed a kind of waggon, one yard long and five inches wide, three and a half inches in height, running upon four brass wheels. On the surface of this waggon are two long rectilinear openings—the one occupying the upper half, and destined to carry the message which is to be sent, the other occupying the lower half, and intended for the message which may be to be received; upon the bridge are two small metal combs, each containing five insulated teeth, answering in number to, and connected with, the insulated conductors of which the line is formed. The combs differ from one another, the one which is to despatch the message, formed of teeth having a certain freedom of action, is on the side of the bridge farthest from the operator; the other, or writing comb, consisting of a similar number of teeth fixed in a block of ivory, side by side in a line the width of the type, rests with a slight but regular pressure transversely on the paper, and occupies the nearer portion of the bridge. These points are made of platinum-iridium alloy. We will suppose that the tables have been tested, and that a number of messages have been sent for despatch; these messages are distributed to a given number of compositors, who set them up in ordinary type with great rapidity; the first that is finished is handed to the operator, whose waggon has already been pushed to the upper end of the rail, and is held there by a simple catch; he places this despatch in the opening destined for it, and on the second opening he places a piece of metal upon which has been laid four, five, or six strips of paper prepared with a solution of nitrate of manganese; this done, he turns a small handle, giving a signal to the operator at the other end, and watches; if the operator at the other end has done his work, the waggons are at once freed from the catch, and are set in motion by a simple weight, the pace being regulated by a fan; the type of one waggon is thus brought under the action of the despatching comb, and runs lightly under its teeth from end to end of the prepared paper, or the other waggon is brought under the receiver's point at the other, and the message will have been printed in clear legible characters, of a deep brown colour, answering with fidelity to the forms over which the corresponding type comb has passed; the message is stripped off, the waggon remounted, the type-box changed, and the process of transmission and reception repeated. As the apparatus at each end is adapted for both transmission and reception, if the operator at the other end has a message to send, it is printed in the

same manner, so that no time is lost. All this, which takes so long to describe, is so rapidly accomplished, that from 450 to 500 messages, of 25 words, may be despatched per hour, the passage of the waggon occupying ten to twelve seconds, during which time two messages have been sent and one received at each end of the line. The printing by means of chemically prepared paper is not new, nor is the production of the message in letters, but the methods hitherto employed have required an absolutely perfect isochronism in the movements of the tracers at the one end and the pen point at the other. Bonelli's system is not dependent on this isochronism, and the message is perfect, even should the carriages at each end of the lines move with a considerable difference of speed, though in practice the carriages are readily adjusted to run at an approximately equal rate. It may be said that five wires are required in this system, while only one is necessary in that of Morse—but it is stated in reply that more than five times as many messages can be sent in the same time, and hence that the difference is in favour of Bonelli. The message, too, requires no interpretation and copying; the strip of paper with the message in printed characters is taken off the machine at once, and forwarded to its destination without loss of time, and without chance of error from transcribing. The whole arrangement is full of ingenious contrivance. In order to get rid of the polarization which would occur at the ends of the receiving points, there is an ingenious arrangement for sending through the line reversals at each signal, a positive current being sent each time the tooth of the comb comes in contact with the type, and a negative current whenever it is insulated. This instrument has been for some time at work commercially between Manchester and Liverpool, and it is now proposed to connect the metropolis with those towns, and the promoters confidently expect that whenever it is established they will be able to reduce the price of messages at least one half. That the system will act successfully on long land lines to the extent of 500 miles, and on short submarine lengths, there is but little doubt, but there would be considerable reason for doubting whether it could be made to work through long submarine cables.

PETROLEUM.—In 1861 the value of the imports into Europe of this earth oil were but £100,000; in 1862 the value had risen to one million, and last year the value of the imports into Europe from America reached £3,000,000. These figures afford ample comment demonstrative of the progress of petroleum up to the present date. Its position is stamped as one of the most prominent and staple products of nature. In 1862, 59 vessels brought to Liverpool 80,050 barrels and 2381 cases of crude and refined. Last year 80 vessels brought to that port 154,689 barrels and 10,992 cases of crude and refined American. Canadian oil has been so unsatisfactory, such a perfect nuisance to all Europe, from the odour emitted, that the trade, echoing the wishes of the authorities, exclude it altogether.

STREET TRAFFIC OF LONDON.—The *Railway News* says: Various expedients have been proposed for relieving the pressure of the street traffic in the City of London,—among the more important of which are new railways, new police regulations, and new streets. The difficulty of solving the problem will be obvious from the mere statement of the facts of the case. On every business day in London upwards of 700,000 persons enter the City by its various approaches, and leave it again in the evening for their homes, at the West-end, in the suburbs, or in the country. Seven hundred thousand persons represent a population equal to the whole inhabitants of South Wales, or of the City of Manchester. Drawn up in line, two deep, standing close together, they would occupy an extent of over 120 miles; and ranged six deep, they would take more than twelve hours to march past a spectator at the rate of 110 paces a minute. Of the 700,000 persons and upwards entering and leaving the City daily (exclusive of those entering the West-end and other parts of London), it was ascertained by the officers of the City Police, in the month of May, 1860, that an average of 535,000 proceeded on foot, and 171,000 in vehicles, making a total of 706,000 persons. The number of vehicles ascertained at the same time to enter the City every twenty-four hours was 57,765, which, if drawn up close in line, would occupy a length of about 260 miles, reaching from London to York, and extending more than fifty miles beyond the latter place. The closeness with which the vehicles follow each other in the streets may be inferred from the fact, that between ten and eleven a.m., on Wednesday, the 19th November, 1862, it was ascertained that the total number passing Bow Church, in both directions, was 1,255, of which 348 were omnibuses, 584 cabs, and 282 carts, drays, vans, and waggons, besides 41 trucks and barrows. The numbers and proportions of vehicles passing the same place between four and five p.m. on the same day were ascertained to be as nearly as possible the same. It is not, however, merely that these vehicles pass into the City and out of it daily, but they bring goods to be discharged from them, or they come for goods to be loaded into them, as the case may be, at the various shops and warehouses in the City. While this is being done,—and the bales of dry goods, parcels of groceries or ironmongery, barrels of oil, wine, spirits, or beer, are passing between the vans, waggons, and trucks, and the warehouses,—the thoroughfares are more or less interrupted, occasioning those blocks of street traffic of which we have recently heard so much. London is fast becoming, if it has not already become, the great distributive centre, not only of the produce of England, but of the world at large. Goods from Manchester, Glasgow, Birmingham, Leeds, Sheffield, Nottingham, and the other manufacturing towns are poured into London, and from thence distributed not only to Europe, India, China, and America, but to the rest of England itself,—the goods in many cases being sent back to be sold by wholesale and retail in the very manufacturing towns from which they had originally come. Even the fish caught round our coast are first sent to London, to the great fish contractors, who distribute it in all directions; the fish being, in many cases returned for consumption to the very fishing towns where it had been first landed. In like manner London has become the centre of the Scotch and Irish salmon trade, and of the Scotch and Continental cattle and meat trades. The surplus corn and fruit of the world find their way first to the London markets, through which they filter out to the other home markets, or are floated away to foreign parts. London, too, has become the central market for the precious metals of the world; and gold and silver are now as regular articles of import and export as butter and cheese. Raw materials from all quarters—tea and silk from China, rice and indigo from India, sugar from the West Indies and the Brazils, wines from France and Portugal, tobacco from Virginia and Cuba—are landed in London, and pass through our docks and warehouses, from which they are distributed by our merchants all over the country, and through innumerable branching arteries reach, in detail, the great body of the people. The City authorities have obtained certain new powers, the judicious exercise of which has already had the effect of considerably mitigating these blocks of the main City thoroughfares. But something more is expected of the City authorities than police regulations, however stringent. We want wider thoroughfares; and they may depend upon it that nothing else will satisfy the public requirements. Compared with Paris, for which a despotic Government has done so much, the streets of the City of London are disgraceful. It is true the City surveyor recommended, before the Traffic Regulation Committee, that more railways should be made in the City; by which means he assumed that the pressure on the traffic would be relieved; but when the new railway termini have been opened, there will be far more street traffic than ever, and moving in a far more limited area. The plain fact is, that it is not so much railways as streets that are wanted. To provide effectually for the proper accommodation of the traffic of London, the City authorities must do as the

Parisian authorities have done—widen the streets. "It is a perfect delusion," said Sir Richard Mayne, "to suppose that anything will effectually relieve the traffic of the streets of London except widening the streets." No doubt the process is a costly one; but London is rich, and is willing to be improved; and the time has arrived when the London thoroughfares must have relief at whatever cost.

Colonies.

NEW ZEALAND EXHIBITION IN 1865.

A commission has been issued by the Governor of New Zealand "for the holding of an Exhibition of the products and manufactures of New Zealand, and such products and manufactures of other countries as may in the opinion of the Commissioners be eminently calculated to be useful in the development of the colony."

The Commissioners, in their official communication, "trust that all friends of New Zealand will assist them in their design to make the resources and capabilities of the colony widely known, and to show to colonists such products and manufactures of other countries, and especially such machines to economize labour as might usefully be introduced here."

The following are the principal "decisions" of the Commissioners likely to be of importance to English exhibitors:—

1. The Commissioners have fixed upon the first Tuesday in January, 1865, for opening the Exhibition.

2. The Exhibition building, with such annexes as may be necessary, will be erected in the City of Dunedin.

3. The principal building will be of brick and cement. The annexes for machinery, &c., will be erected adjoining the main building.

4. The decision whether goods proposed to be exhibited are admissible or not, must in each case eventually rest with the Commissioners.

5. Subject to the necessary limitation of space, all persons, whether designers, inventors, manufacturers, producers, or possessors of articles of New Zealand origin, or of such others the produce of other countries as may in the estimation of the Commissioners be eminently calculated to aid in the development of the colony, will be allowed to exhibit; but they must state in what character they exhibit.

6. The Commissioners will communicate with New Zealand Exhibitors only through the Local Committee of their respective Provinces, and with those of neighbouring Colonies, of Great Britain and Ireland, and of Foreign Countries, either through the Agent in London or directly through the Secretary in Dunedin.

7. No rent will be charged to exhibitors.

8. Subject to decisions 5 and 6, every article produced or obtained by human industry will be admitted to the Exhibition, belonging to any one of the four following sections:—I. Raw materials. II. Machinery. III. Manufactures. IV. Fine Arts.

The exceptions are—Living animals and plants; fresh vegetables and animal substances liable to spoil by keeping; detonating or dangerous substances.

9. Spirits or alcohols, oils, acids, corrosive salts, and substances of highly inflammable nature will only be admitted by special written permission and in well secured glass vessels.

10. The articles exhibited will be divided into forty classes under the above four sections.

11. Prizes or rewards for merit in the shape of Honorary Certificates will be given in Sections I., II., and III. These certificates will be of one class for merit without any distinction of degree. No exhibitor will receive more than one certificate in any class or sub-class. A jury will be formed for each class of the exhibition by whom the certificates will be adjudged, subject to general rules, which will regulate the action of the juries. The jurors will be chosen by the Commissioners. The names of all the jurors will be published in January, 1865. The juries will be required to submit their awards with a brief statement of the grounds of each to the Commissioners before the 10th day of March, 1865. The awards will be published in the exhibition building at a public ceremony, and will immediately afterwards be conspicuously attached to the counters of the successful exhibitors, and the grounds of each award will be very briefly stated. If an exhibitor accepts the office of juror, no certificate can be awarded in the class to which he is appointed, either to himself individually or to the firm in which he may be a partner. The certificates will be delivered to the exhibitors on the last day of the exhibition.

12. Prices may be affixed to articles exhibited.

13. The Commissioners will be prepared to receive all articles which may be sent to them on and after the first day of October, and will continue to receive goods until the twelfth day of December, 1864, inclusive.

14. Articles of great size or weight, the placing of which will require considerable labour, must be sent before the 21st of November, 1864; and manufacturers wishing to exhibit machinery or other objects that will require foundations or special constructions must make a declaration to that effect in their demands for space, which demand the Commissioners must receive at least three months previous to the day of opening.

15. Any exhibitor whose goods can properly be placed together will be at liberty to arrange them in his own way, provided his arrangement is compatible with the general scheme of the exhibition and the convenience of other exhibitors.

16. Where it is desired to exhibit the process of manufacture, a sufficient number of articles, however dissimilar, will be admitted for the purpose of illustrating the process, but they must not exceed the number actually required.

30. Regulations will be adopted by the principal steam companies and others trading to Dunedin, with the view of affording facilities for the conveyance of goods to and from the exhibition.

35. As a general rule, no counters or fittings will be provided by the Commissioners. Exhibitors will be permitted, subject only to the necessary general regulations, to erect to their own taste all the counters, stands, &c.

43. Exhibitors must be at the charge of insuring their own goods, should they desire this security. Every precaution will be taken to prevent fire, theft, or other losses, but the Commissioners will not be responsible for losses or damage of any kind.

44. Exhibitors may employ assistants to keep in order the articles they exhibit, or to explain them to visitors.

50. Articles once deposited in the building will not be permitted to be removed without written permission from the Commissioners.

55. The Commissioners will provide shafting, steam (not exceeding 30 lbs. per inch), or water at high pressure for machines in motion.

56. Persons who may wish to exhibit machinery in motion will be allowed to have it worked as far as practicable under their own superintendence and by their own men.

104. By arrangements made with the New Zealand Government, all foreign or colonial goods intended for exhibition, sent and addressed in accordance with the regulations laid down by her Majesty's collector of customs, will be admitted into the country and allowed to be transmitted to the exhibition building without being previously opened, and without payment of any duty. But all goods which shall not be re-exported at the termination of the exhibition, will be charged with the proper duties under the ordinary Customs' regulations.

106. Every article sent separately, and every package, must be legibly marked with the name of the country

or colony of which it is the produce or manufacture, and as far as practicable with the name of the exhibitor or exhibitors.

107. The following is the form of address which should be adopted:—

To the Commissioners for the New Zealand Exhibition, 1865.
BUILDING, DUNEDIN, OTAGO,
N. Z.
From [state country and exhibitor's name].

To prevent loss, miscarriage, or mislaying, articles or packing-cases containing them, which occupy less bulk than two cubic feet, should not be sent separately if it can be avoided, but packages under such size, containing as far as possible the same classes of articles, should be transmitted in combination.

The following outline of the Patent Law of New Zealand is inserted for the information of exhibitors from a distance, but it is not the intention of the Commissioners to take any steps in reference to the protection of inventors or discoverers by patent or registration:—Under the "Patents Act, 1860," any person, being the originator of any new invention or improvement, for which no patent has been issued in New Zealand or any other country, may obtain letters patent after depositing £10 with the Colonial Treasurer, and at the office a petition to the Governor, stating the object of his invention and praying for a patent. The specifications and drawings must be delivered in duplicate, with principle of machines, &c., explained, and specimens of ingredients, &c., if any, for purpose of experiment be delivered. Notice to be published in the *Gazette*, and one newspaper in each province, and after four months, if no objection is lodged, a patent may be issued; the holder to be entitled to the same privileges in New Zealand as patentee under the Great Seal in England. More than 12 persons may be interested in a patent. Patent may be assigned. The holder or assignee of letters patent obtained in Great Britain or other countries, may obtain letters of registration, entitling the holder during continuance of the original patent in the country in which it was granted, and no longer, to all the privileges of letters patent granted in New Zealand, on payment of £10 to the Colonial Treasurer.

110. No prizes will be awarded in Section IV. (Fine Arts).

Obituary.

The death of M. CHRISTOFLE was announced on the 16th of December, at the last meeting of the *Société d'Encouragement*, of Paris, by M. Dumas, the President, who took occasion to express the great loss the Society, as well as the commercial world of France, had sustained by the death of one who took foremost rank as a leader of industry in that Empire. All who visited the Exhibition of 1862 will remember the splendid display made by M. Christofle in that contest of nations, and how prominent a position articles sent by him held in adorning the French Court. Like our Elkington here, M. Christofle was the founder of the new industry of electro-metallurgy in France. Christofle, however, laid no claim to the title of inventor, or man of science, but he had thorough knowledge and appreciation of art; he commenced his career as an apprentice for three years, was afterwards a journeyman for one year, at the expiration of which he became a partner in the house Calmette. At the age of twenty-four he took the lead in the working of the precious metals, and obtained the gold medal at the Paris National Exhibition, in 1839, having been at the head of the above establishment ever since 1831. In 1834 he received the second gold medal for his display in the Exhibition of that year. He at a very early period saw the importance, in his trade, of the new art of electro-metallurgy, and at once bought at high prices the patents of Ruolz and of Elkington, at that time rival patentees. The history of Christofle is one of the most striking instances of perseverance and strong will. It required no small self-reliance to embark in a new and untried path of industry. His first payment to Ruolz, 500,000 francs to Elkington, second payment to Ruolz of 160,000 francs, and the necessary expenses involved in starting the industry, absorbed Christofle's whole fortune; he applied to his friends, who trusted him with 1,600,000 francs in addition, and thus he established a manufacture of enormous magnitude, in respect of which, before the expiration of the year 1844, he had received public recognition in the form of medals and the Cross of the Legion of Honour. But he did not achieve this position without a severe struggle, he was beset on all sides with pirates, who sought to rob him of the inventions he had so dearly purchased, and of the hard-earned fruits of his laborious exertions. He, however, succeeded in overcoming these adversaries, though at an enormous expense in litigation and otherwise. In 1847 the returns of the firm amounted to two million francs, and in 1859 they reached two million five hundred thousand. In 1851 he had again to defend his patents in the courts of law, and again he succeeded. From this period down to the day of his death his life was a long career of success, and he carried off medals of the highest grade at every exhibition, whether national, international, or provincial. The capital of the firm rose to three millions, and under the active superintendence of M. Ribes, whom he took into partnership, the capital exceeded six millions in 1859. In this year, in order to avoid certain Custom-house difficulties, he established an additional factory in Carlsruhe. He gathered around him an able staff of artists and skilled workmen, having in his employ upwards of 1,500 persons, and the firm is stated to have plated 5,600,000 pieces of plate, and to have used 33,600 kilogrammes of silver for the purpose, of the value of six million francs. This quantity of silver, if spread out in sheets the usual thickness of the plating, *i.e.*, at the rate of three grammes per square decimetre (forty-five grains per sixteen square inches) would cover a surface of 1,600 hectares (3,950 acres English).

Forthcoming Publications.

ELEMENTARY DRAWING COPY BOOKS, for the use of children from four years old and upwards in schools and families, compiled by a student certificated by the Science and Art Department as an art teacher, is announced for publication by Messrs. *Chapman and Hall*. These are prepared like copy books for writing. They fill seven books. Price 8d. each, or 3s. 6d. the set.

Notes.

ROYAL HORTICULTURAL SOCIETY.—For the encouragement of the study of scientific botany among all classes, the Royal Horticultural Society offers the following prizes for botanical collections:—1. One silver, and two bronze medals for the three best collections of wild plants of each separate county of the United Kingdom, dried, mounted on paper, folio demy size, classified according to the natural system, and labelled with the name of the locality where found, and the date when found. Intending competitors may obtain the forms of labels on sending twelve postage stamps to the Secretary of the Royal Horticultural Society, South Kensington. 2. Three gold medals will be given for the three best of all the collections out of all the several county collections. Not more than one of the medals can be awarded in one county. The names of the judges will be hereafter announced. The collection of plants must be arranged according to any natural method, and be accompanied by a list arranged

according to the same method with the species numbered. The collector to follow some work on British Botany, such as that of Babington, Hooker and Arnott, or Bentham, and to state the work which he adopts. The name of each plant, its habitat, and the date of collection to be stated upon a label affixed to the paper on which it is preserved. (The paper and label to be similar to the specimens which will be supplied; on sending twelve postage stamps, by the Secretary of the Horticultural Society to intending competitors.) The judges will not award the prize unless the selection is a fair representation of the plants to be found in the county in which they have been collected. In judging of the respective merits of the collections, attention will be paid not merely to the number of the species, but also to the condition and rarity of the specimens, and the mode in which the plants are dried and preserved. The collections must be delivered on or before 31st December, 1864, to the Secretary of the Royal Horticultural Society, South Kensington, carriage free, marked with a number or cypher, and accompanied with a sealed letter, containing the collector's name, the address, and the price at which the collection can be sold or another made. The sealed letter which accompanies each collection must contain a declaration, signed by the collector, in the following terms:—"The plants which accompany this note were collected by myself from the fields and woods within the limits of the county of after the 1st of February, 1864." Further, a Society's gold medal will be awarded to every exhibitor of a new species of plant found growing in the United Kingdom.

THE BRONZE AND COPPER COINAGE.—It is stated that the old copper coin will be ere long declared an illegal tender, and that the Master of the Mint is particularly desirous to afford facilities for its return to the Mint previous to the issue of an official proclamation.

STEAM-BOILERS.—It is reported that M. Domslain, an officer in the imperial navy, has solved a problem of great importance in steam navigation—the substitution of fresh for salt water in the boilers, an invention likely greatly to increase their durability.

MEETINGS FOR THE ENSUING WEEK.

MON. ...Entomological, 7.
British Architects, 8.
Medical, 8½. Clinical discussion.
United Service Inst., 8½. Capt. E. G. Fishbourne, R.N., "Naval Ordnance."
Royal Inst. 2. General Monthly Meeting.

TUES. ...Civil Engineers, 8. Discussion upon Mr. Redman's paper on "The East Coast, between the Thames and the Wash Estuaries."
Pathological, 8.
Photographic, 8. Annual Meeting.
Anthropological, 8.
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Experimental Optics."

WED. ...Society of Arts, 8. Mons. E. Vial, "Instantaneous Engraving upon Metal," with experiments.
Geological, 8. 1. Sir R. I. Murchison, K.C.B., and Professor R. Harkness, F.R.S., "On the Permian Rocks of the North west of England, and their Extension into Scotland." 2. Mr. J. Wyatt, F.G.S., "On further Discoveries of Flint Implements and Fossil Mammalia."
Pharmaceutical, 8.
R. Society of Literature, 8½.

THUR. ...Royal, 8½.
Antiquaries, 8.
Chemical, 8. Dr. How, "On Mordenite."
R. Society Club, 6.
Royal Inst., 3. Prof. Tyndall, F.R.S., "On Experimental Optics."
Linnæan, 8. 1. Mr. John Scott, "Observations on the Functions and Structure of the Reproductive Organs in the *Primulacea*." 2. Mr. Walter Moxon, "Notes on some points in the Anatomy of *Rotatoria*."

FRI.....R. United Service Inst., 3. Capt. F. E. B. Beaumont, R.E., "Balloon Reconnaissance."
Royal Inst., 8. Mr. J. A. Froude, "On the Science of History."
Philological, 8.
Archæological Inst., 4.

SAT. ...Royal Inst., 3. Mr. J. Lubbock, "On the Antiquity of Man."

Patents.

From Commissioners of Patents Journal, January 22nd.

GRANTS OF PROVISIONAL PROTECTION.

Bird cages—93—S. Robotham.
Boots, &c.—51—W. Pidding.
Brick-making machinery—2318—J. Farmer and C. Hadfield.
Brooches, &c., fastenings for—53—I. Lazarus.
Brushes—69—J. N. Garrod.
Carding engines, "cards" for—8—W. Allen and W. Johnson.
Carriages—3—J. W. Nottingham, W. H. P. Gore, and A. H. A Durant.
Collar—24—G. Speight.
Cotton scutching—3201—W. Noton.
Cotton spinning—2—J. Gee.
Fabrics—3259—N. Lloyd and E. Hargreaves.
Fire-arms, breech-loading—3308—A. Byrnes and H. Benjamin.
Fish, &c., paralyzing, &c.—2644—I. Baggs.
Footlights, &c.—22—C. Defries.
Furnaces—63—W. C. Beatson.
Furnaces—4—E. B. Wilson.
Gas, &c., generating—33—J. Kidd.
Gates, &c., fastening—2934—L. D'E. de Saint Jean.
Guns, mounting—3309—J. Radley.
Gymnastic apparatus—99—W., G., T., and A. Hanlon.
Hose coupling—75—W. E. Newton.
Lamps—97—M. A. Dietz.
Locks, &c.—28—J. B. Fenby.
Locks, &c.—57—P. Walters.
Looms—65—J. Webster.
Looms—3304—J. Starkey, J. Haworth, and J. K. Phippin.
Millboard, &c., cutting—79—D. Nickols.
Motive power, generating and applying—77—H. M. Nicholls.
Mules, self-acting—38—H. Nelson and J. Heap.
Optical illusions—3209—C. Bolton.
Ores, smelting—16—W. Balk.
Paper, &c., manufacture—23—A. L. Le Harivel.
Peat, &c.—30—J. J. Hays.
Piled fabrics—3306—J. Clegg.
Pneumatic apparatus—3285—L. E. Desestre.
Potatoes, &c., cleansing—91—J. Clay.
Presses, letter copying—6—W. Muir.
Propelling vessels—87—J. Wheatley.
Railway signals—32—C. W. Harrison.
Rifle targets—95—G. W. Hart.
Scarfs, &c., fastening for—3303—W. F. Brown.
Screws, cutting, &c.—21—M. Bayliss.
Seed sowing, &c.—2873—L. L. Sovereign.
Sewing machines—12—H. A. Bonneville.
Sewing machines—25—J. H. Johnson.
Sewing machines—42—J. Cumming.
Ships, trimming—3231—W. L. and T. Winans.
Show cases—26—R. Tomlinson.
Steam engines—59—W. Brookes.
Steel, &c., manufacture—3233—D. Adamson.
Street lamps, &c.—83—J. Browning.
Targets—55—J. F. Bland.
Umbrellas, &c.—40—J. I. and H. G. Tracey.
Wall-paper, colouring—3133—R. A. Brooman.
Window sashes—20—J. Askew.
Wool, &c., spinning—36—H. Blakey and J. Alderson.

PATENTS SEALED.

1861. J. W. Welch.	1892. W. and J. Graham.
1861. J. Whittaker.	1893. G. Sigl.
1871. A. Hector.	1928. E. A. Cowper.
1877. P. H. Girardin.	2752. R. Sellar.

From Commissioners of Patents Journal, January 26th.

PATENTS SEALED.

1681. C. Schiele.	1958. E. Morewood.
1882. F. Sturge.	1977. D. W. Barker.
1883. G. Inskeep.	2124. J. Shaw.
1886. J. T. Stephens & C. Hoare.	2214. J. Lillie and J. H. White.
1891. T. Apps.	2401. J. Mackay.
1908. R. E. Bibby.	2522. H. A. Bonneville.
1911. J. E. Vanner.	2926. H. A. Bonneville.
1922. S. Bury and J. Price.	3059. H. A. Bonneville.
1923. J. H. Walsh.	3103. W. H. Cole.
1957. T. W. Guillod.	

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

152. C. W. Lancaster, J. Brown, and J. Hughes.	205. A. F. Yarrow and J. B. Hilditch.
167. C. W. and F. Siemens.	216. H. Bessemer.
172. E. Ellis.	288. D. Walmsley & J. Rostron.
185. W. Wilson.	321. W. M. Storm.
198. J. Vero.	330. J. L. Jullion.
213. R. Mushet.	202. S. Needham.
176. A. E. Holmes.	206. C. Lungley.
175. J. Chatterton & W. Smith.	

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

167. T. Johnston.	221. H. Bessemer.